SLOVENSKI STANDARD
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Cevni sistemi iz litega železa za odvodnjavanje iz stavb - Karakteristike in preskusne metode

Cast iron pipes systems for the evacuation of water from works - Characteristics and test methods

ussrohrsysteme zur Ableitung von Wasser aus Entwässerungsanlagen - Eigenschaften und Prüfverfahren

Réseaux de canalisations en fonte pour l'évacuation des eaux des bâtiments - Caractéristiques et méthodes d'essai

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23.040.40	Kovinski fitingi	Metal fittings
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EUROPEAN STANDARD
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EN 877

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English Version

Cast iron pipe systems and their components for the evacuation of water from works - characteristics and test methods

Réseaux de canalisations en fonte et leurs composants pour l'évacuation des eaux des bâtiments - Caractéristiques et méthodes d'essai

Rohrsysteme aus Gusseisen und ihre Komponenten zur Entwässerung von Gebäuden - Merkmale und Prüfverfahren

This European Standard was approved by CEN on 16 August 2021.

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European foreword

This document (EN 877:2021) has been prepared by Technical Committee CEN/TC 203 “Cast iron pipes, fittings and their joints”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2022, and conflicting national standards shall be withdrawn at the latest by April 2022.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a Mandate given to CEN by the European Commission and the European Free Trade Association.

This document supersedes EN 877:1999, EN 877:1999/A1:2006 and EN 877:1999/A1:2006/AC:2008.

This document includes the following significant technical changes with respect to the previous:

a) Product standard has been extended to kit and components standard.

b) Chapter 4 about characteristics has been restructured with all essential characteristics first.

c) Grip collars have been included as kit components.

d) Pressure tightness including Fittings with access as a kit component has been added.

e) Fire reaction classification has been amended with the agreement of WG 4 of TC 127.

f) Chapter 6 about Assessment and verification of constancy of performance – AVCP has been updated.

This document is one of a series of standards for cast iron products for pipelines for various applications.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This document specifies product characteristics, test/assessment methods and how to express test/assessment results. Cast iron pipelines kits are usually composed of cast iron pipes, fittings, joints and accessories.

This document covers the range of nominal diameter from DN 40 to DN 600 inclusive.

The cast iron includes grey cast iron and ductile cast iron.

The roof gullies used for siphonic systems are outside the scope of this document.

Sewerage applications are outside the scope of this document.

It is intended to be used for the construction of gravity or vacuum discharge pressurized or unpressurised networks installed inside and/or outside works, above and/or below ground and in construction works.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 598:2007+A1:2009, *Ductile iron pipes, fittings, accessories and their joints for sewerage applications - Requirements and test methods*

EN 681-1:1996, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

EN 10088-1, *Stainless steels — Part 1: List of stainless steels*

EN 10204, *Metallic products — Types of inspection documents*

EN 13501-1:2018, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

EN 13823, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

EN ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread (ISO 898-1)*

EN ISO 898-2, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 2: Nuts with specified property classes — Coarse thread and fine pitch thread (ISO 898-2)*

EN ISO 1514, *Paints and varnishes — Standard panels for testing (ISO 1514)*

EN ISO 1716, *Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value) (ISO 1716)*

EN ISO 2409, *Paints and varnishes — Cross-cut test (ISO 2409)*

EN ISO 2808, *Paints and varnishes — Determination of film thickness (ISO 2808)*

EN ISO 2812-1, *Paints and varnishes — Determination of resistance to liquids — Part 1: Immersion in liquids other than water (ISO 2812-1)*

EN ISO 3506-1, *Fasteners — Mechanical properties of corrosion-resistant stainless steel fasteners — Part 1: Bolts, screws and studs with specified grades and property classes (ISO 3506-1)*

EN ISO 3506-2, *Fasteners — Mechanical properties of corrosion-resistant stainless steel fasteners — Part 2: Nuts with specified grades and property classes (ISO 3506-2)*

EN ISO 4628-2, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 2: Assessment of degree of blistering (ISO 4628-2)*

EN ISO 4628-3, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 3: Assessment of degree of rusting (ISO 4628-3)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1)*

EN ISO 6892-1:2019, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2019)*

EN ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests (ISO 9227)*

EN ISO/CIE 11664-4, *Colorimetry — Part 4: CIE 1976 L*a*b* colour space (ISO/CIE 11664-4)*

EN ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2)*

ISO 185:2020, *Grey cast irons — Classification*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
discharge system for buildings
system of pipes, fittings, accessories and joints used to collect and drain waste water and rainwater from a building; it comprises discharge pipes, stack ventilation and rainwater pipes, installed within the limits of a building or attached to the building and this includes pipes between the building and the inspection chambers

Note 1 to entry: This applies to gravity or vacuum, inside and outside buildings, above and below ground.

3.2
drain
system of pipes, fittings, accessories and joints installed outside the limits of a building in order to connect the discharge system of this building to a sewer or a septic tank

3.3
sewer
system of pipes designed to collect waste water and rainwater from buildings and surface water and to convey them to the point of disposal or treatment

3.4
cast iron
alloy of iron and carbon in which graphite can be present in different forms

3.5
kit
construction product placed on the market by a single manufacturer as a set of at least two separate components that need to be put together to be incorporated in the construction work

Note 1 to entry: The wording cast iron pipe systems is here in this document equivalent to cast iron pipe kits.

[SOURCE: CPR N° 305/2011 of 9 March 2011]

3.6
pipe
kit component casting of uniform bore, straight in axis, normally having plain ends but which can also be socketed

3.7
fitting
kit component in cast iron which allows a deviation, a change of direction or diameter, including access elements and traps

3.8
coupling
kit component, which is a jointing element for pipes and/or fittings subjected to internal or external pressure

3.9
gasket
kit component providing sealing function to joints

3.10
clamping
kit component, which is a securing element for pipes and/or fittings subjected to internal pressure, providing axial restraint to the end thrust arising from a change of direction, blank end etc., e.g. grip collars

3.11
grip collar
kit component that ensures axial restraint up to a defined pressure by mounting it over a joint

3.12
joint
connection between the ends of pipes and/or fittings, including the coupling or clamping component, with sealing effected by elastomeric gasket(s); as soon as it is an assembly of several kit components as coupling, clamping or gaskets, the joint is a kit

3.13
accessory
kit component, any element used in a network, e.g. for maintenance or inspection reasons

3.14
nominal size
DN
alphanumerical designation of size for components of a pipework system, to be used for reference purposes, which comprises the letters DN followed by a dimensionless which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections

Note 1 to entry: In this document, it is the bore.

[SOURCE: EN ISO 6708]

3.15
length
effective length of a pipe or fitting

Note 1 to entry: For double spigot pipes and fittings, the effective length is equal to the overall length. For spigot and socket pipes and fittings, the effective length is equal to the overall length minus the spigot insertion depth as given by the manufacturer.

3.16
range of products

design system produced by one manufacturer for which the test results for one or more characteristics from any one product within the range are valid for all other products within this range

3.17
cast iron pipe system under vacuum
siphonic system for draining rainwater and vacuum system for waste waters

3.18
design system
collection of components from which a “kit” may be created for subsequent installation in the works

Note 1 to entry: A design system might, for example, be presented in a supplier’s catalogue, from which the purchaser can make a choice. A design system can give rise to one or many different “kits”, but the system itself cannot be bought.

3.19
assembled system
kit after it has been installed in the works

Note 1 to entry: An “assembled system” may be made up only of the “kit” or it may comprise the “kit” assembled with one or more other products which could themselves be construction products.

4 Characteristics for cast iron pipe systems and components

4.1 Crushing strength (only for grey cast iron)

Cast iron components as pipes, fittings and accessories shall have the minimal crushing strength given in Table 7. Test method is described in 5.6.

The assessment of each of those components insures the assessment of the kit.

4.2 Impact resistance for kits

The impact resistance assessment is given by the mechanical properties of pipes, fittings and accessories. They shall have the minimal tensile strength and maximum Brinell hardness as given in Table 7 in 4.10.2.

Test method for tensile strength is given in 5.4.

Test method for Brinell hardness measurement is given in 5.5

4.3 Tightness: gas and liquid

4.3.1 General

NOTE In this document, all pressures are relative pressures, expressed in bar (100 kPa = 1 bar).

The assessment of each component as described in this 4.3 insures the assessment of the kit.

4.3.2 Lengths of fittings and sealing zone

Lengths of fittings shall be given in the manufacturers' catalogues. When measured in accordance with 5.2.7, the lengths of fittings shall be within a tolerance of ± 5 mm.

The ends of the fittings shall have sealing zones straight in axis and free from marking and free from defects which could impair the fitness for use.

The length *T* (see Figure 1) of this sealing zone shall comply with the values given in Table 1.

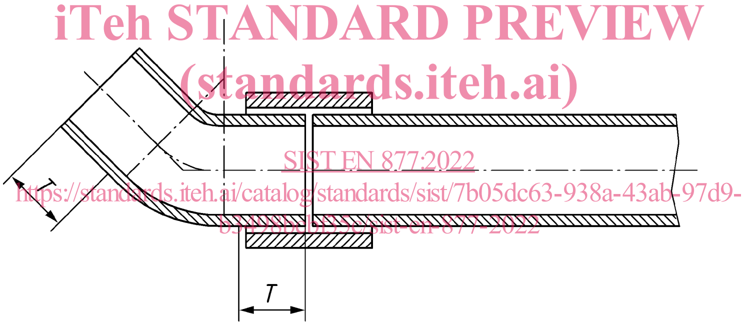

Figure 1 — Length of the sealing zone

4.3.3 Geometry of fittings and accessories

The geometry of fittings and accessories is not part of this document. Fittings and accessories of geometry used in various countries are in conformity with this document as long as they comply with all other technical requirements of this document.

Table 1 — Sealing zone of fittings

DN	Length *T* of sealing zone mm	Lower deviation on *T*[a] P mm
40	30	- 5
50	30	
70	35	
75	35	
100	40	
125	45	
150	50	
200	60	- 4
250	70	
300	80	
400	80	
500	80	
600	80	

[a] Upper deviations are not given and sealing zones with a length greater than *T* are permitted.

4.3.4 Water tightness

4.3.4.1 Water tightness of pipes and fittings

4.3.4.1.1 Water tightness of pipes

Water tightness of pipes can be demonstrated by the following calculation.

$$P = \frac{20 \times e \times R_m}{D \times S_F}$$

where

e is the minimum pipe wall thickness, in millimetres;

D is the mean pipe diameter ($DE - e$), in millimetres;

DE is the nominal pipe external diameter (see Table 6), in millimetres;

R_m is the minimum tensile strength of cast iron, in Megapascals;

(420 MPa for spheroidal graphite cast iron and 200 MPa for grey cast iron; see 4.10.2);

S_F is a safety factor of 3.

For a DN 100 pipe in grey cast iron, the internal pressure strength is more than 35 bars.

Expected results are given in Table 2.

4.3.4.1.2 Water tightness of fittings

4.3.4.1.2.1 Fittings without access or door

Expected results for water tightness of fittings without access or door are given in Table 2 and the demonstration done for pipe is valid for these fittings.

4.3.4.1.2.2 Fittings with access or door

When tested in accordance with 5.8, fittings with access or door shall exhibit no visible leakage from the access or door when subjected to the internal hydrostatic test pressure given in Table 2.

Table 2 — Water tightness of fittings with access or door - performance requirements

Internal test pressure in bar	
DN ≤ DN 200	DN > DN 200
0 to 5[a]	0 to 3[a]
[a] 0 to 0,5 bar water pressure for fittings which will only carry limited pressures because of their intended use and installation e.g. sanitary application.	

4.3.4.2 Water tightness of joints

4.3.4.2.1 General

When tested in accordance with 5.9.4 and 5.9.5, on test apparatus preventing any excessive axial displacement and subjected to the test conditions and hydrostatic pressures given in Table 4, the joints shall exhibit no visible leakage.

Table 3 specifies the hydrostatic test pressures for the following test conditions:

a) joint with pipes aligned;

b) joint with pipes deflected to an angle of at least:

   3° for nominal sizes up to and including DN 200;

   1°45′ for nominal sizes greater than DN 200;

c) joint subject to a shear force of at least 10 DN in newtons, with pipes aligned.

Table 3 — Water tightness of joints - performance requirements

Test condition	Hydrostatic test pressure in bar			
	DN ≤ DN 200		DN > DN 200	
	internal	external	internal	external
1) aligned	0 to 5 [a]	0 to 0,5 [b c]	0 to 3 [a]	0 to 0,5 [b c]
2) deflected	0 to 5 [a]	–	0 to 3 [a]	–
3) subject to shear force	0 to 1 [a b]	–	0 to 1 [a b]	–

[a] 0 to 0,5 bar water pressure for joints which will only carry limited pressures because of their intended use and installation; 0 to 0,1 bar water pressure for joints connecting to sanitary ware, e.g. WC, washbasin and non-pressurized gravity flow.

[b] Applicable to socketed joints only when they are to be buried.

[c] Does not apply to nominal sizes less than DN 100 and does not apply to joints connecting to sanitary ware, e.g. WC, washbasin.

4.3.4.2.2 Water tightness for buried systems

For joints which are used exclusively for buried kits, the internal hydrostatic test pressure specified in Table 3 lines a) and b) may be limited to 1 bar. This may limit to 1 bar also the test pressure specified in Table 4 for buried grip collars.

4.3.4.2.3 Water tightness for rainwater systems installed outside buildings

Joints shall be watertight at least to non-pressurized gravity flow. See note a) in Table 3.

4.3.4.3 Resistance to end thrust with grip collars

When tested in accordance with 5.10.3, on test apparatus preventing any excessive axial displacement and subjected to the test conditions:

— joint with pipes aligned;

— internal hydrostatic pressures given in Table 4;

the grip collars shall limit the axial movement of pipes. During each stage in pressure, there shall be no axial movement of the pipes.

Table 4 — Resistance to end thrust of grip collars - performance requirements

Test condition	Internal test pressure in bar	
	DN ≤ DN 200	DN > DN 200
aligned	0 to 5	0 to 3

4.3.5 Air tightness

In order to ensure a seal against odours, all joints shall be tight against positive internal air pressure of 0 mbar to 10 mbar when tested in accordance with 5.9.6.

4.4 Vacuum tightness (only for under vacuum evacuation of water from works)

4.4.1 General

The assessment of each component as described in this 4.4 insures the assessment of the kit.

4.4.2 Pipes resistance to vacuum

Expected results for pipes resistance to vacuum are given in Table 5, see 4.4.4.

4.4.3 Fittings – resistance to vacuum

4.4.3.1 Fittings without access or door

Expected results for resistance to vacuum of Fittings without access or door are given in Table 5. The demonstration done for pipe is valid for these fittings.

4.4.3.2 Fittings with access or door

When tested in accordance with 5.8, fittings with access or door shall withstand a negative pressure. An initial negative pressure of −0,8 bar is generated and after a waiting time of 1 h, the final pressure shall not reach the limiting values given in Table 5.

4.4.4 Joints – resistance to vacuum

In addition to the technical requirements of 4.3.4.2, 4.3.5 and 4.12 and when tested in accordance with 5.13, the joints shall withstand a negative pressure. An initial negative pressure of −0,8 bar is generated and after a waiting time of 1 h, the final pressure shall not reach the limiting values given in Table 5.

Table 5 — Resistance to vacuum - performance requirements

Test condition	Test pressure in bar	
	DN ≤ DN 200	DN > DN 200
aligned	−0,7	−0,4

4.5 Maximum load for admissible deformation (only for below ground)

Maximum load of kits and components can be assessed by the maximum load of the pipe.

The load bearing capacity expressed by the load per unit length uniformly distributed on the top of the pipe are evaluated by means of the formula below:

$$f \geq \frac{\pi.\sigma.e_{\min}^{2}}{3\left(DE_{\max} - e_{\min}\right)}$$

where

- f is the ultimate load per unit length on the top of the pipe, in newtons per millimetre;
- $e_{\min}$ is the minimum wall thickness of the pipe, in millimetres;
- $DE_{\max}$ is the maximum external diameter, in millimetres;
- σ is the ring crush strength in accordance with Table 7, in megapascals.

4.6 Reaction to fire (only for above ground evacuation of water from works and under vacuum evacuation of water from works)

4.6.1 Reaction to fire of components

As written in the scope of EN 13501-1:2018, products are considered in relation to their end use application. Components are always assembled with other components into a system, therefore the assessment of single component is not considered as appropriate. Consequently, the assessment only applies to kit.

4.6.2 Reaction to fire of kits

The reaction to fire indicates the degree of contribution of the material to the behaviour of the construction product in the event of fire. When tested in accordance to the test methods given in 5.7.3.3, relevant for the claimed class, the test results are expressed as a class according to EN 13501-1.

Whether products covered by this document are made from one or more of the materials that have been considered, under established conditions, as belonging to the category “No contribution to fire” because of their low level of combustibility, the reaction to fire class A applies to these products without the need of carrying out reaction to fire tests.

The mounting and fixing conditions for the SBI test are given in Annex F.

Considering the products in their end-use conditions as an assembled system:

— internal coatings are not relevant as they are not exposed to fire (a very small volume of smoke can be created but this will exit the building via stacks vents);

— gaskets of joints are not relevant either as in the end-use conditions they are not exposed to fire (except for some designs a very small compressed edge) and as such represent a very low quantity of organic material.

In order to verify these assumptions, they shall be tested according to Annex F using the mounting adaptations given.

According to EN 13501-1, as the gross calorific potential (PCS) of the products considered as an assembled system including pipes, fittings and couplings, due to their densities and weight quantities, will always satisfy the requirement on PCS for the product as a whole (≤2,0 MJ/kg), the reaction to fire classification shall be obtained as follows:

— external coatings, if containing more than 1 % by weight or volume (whichever is the more onerous) of homogeneously distributed organic material, shall satisfy the requirements of 4.11.3 on ignitability or gross calorific potential, depending on the intended class of reaction to fire;

and

— a range of products (including coated pipes, coated fittings, couplings and possibly grip collars) shall be tested according to Annex F using the mounting adaptations given, and shall satisfy the requirements of classification criteria and additional classifications listed in EN 13501-1 for the intended class of reaction to fire. If a range of products includes grip collars, as these products are not always installed on the discharge system depending on the intended performance:

  — the test shall be done without them to evaluate the behaviour of the couplings without any protection to the flame;

  — and only if the grip collars include an organic material, the test shall be done again with the grip collars installed on top of the couplings (see Annex F).